UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/800,727	03/16/2004	Atsushi Hirota	118925	1036

25944 7590 01/23/2008

OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
FIDLER, SHELBY LEE	
ART UNIT	**PAPER NUMBER**
2861	

MAIL DATE	DELIVERY MODE
01/23/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/800,727	HIROTA, ATSUSHI	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 October 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8 and 15-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 15-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/29/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/29/2007 has been entered.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 10/29/2007 has been considered by the examiner.

Claim Objections

Claim 21 is objected to as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Lines 12-13 of the claim state that the dummy electrodes are "at positions other than positions corresponding to the pressure chamber" (singular). However, no single pressure chamber had been previously identified. For the purpose of examination, Examiner assumes that this limitation applies to the claimed "pressure chambers" (plural).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Takahashi et al. (US 5266964).

Regarding claim 1:

Takahashi et al. disclose an ink-jet head, comprising:

a passage unit (channel 34) in which a plurality of pressure chambers (ink channels 32), each connected to a corresponding nozzle (col. 4, lines 51-58), are arranged adjacent to each other along a plane (Fig. 1); and

an actuator unit (laminated piezoelectric element 38) that is fixed to the passage unit (Fig. 1) to change the volume of the pressure chambers (col. 4, lines 51-58),

wherein the actuator unit includes:

a piezoelectric element (piezoelectric ceramic layers 40) that spans a plurality of pressure chambers (Fig. 1),

a plurality of individual electrodes (interior positive electrodes 44) that have been sintered on a surface of the piezoelectric element (col. 4, lines 1-4) at positions corresponding to the respective pressure chambers (col. 3, lines 38-41), and

one or more sintered members (interior negative electrodes 42; col. 4, lines 1-4) of the same residual stress characteristics as the individual electrodes (this characteristic is inherent to the disclosure provided in col. 3, line 47 - col. 4, line 4 & Figs. 1-3) at positions other than

positions corresponding to the pressure chambers (col. 4, lines 36-38) and that are, on the surface of the piezoelectric element provided with the plurality of individual electrodes (Fig. 1), spaced from an outermost one of the individual electrodes with respect to an arrangement direction of the plurality of individual electrodes, in an outward direction from the plurality of individual electrodes (Fig. 3).

Regarding claim 2:

Takahashi et al. disclose all the limitations of claim 1, and that the sintered members (42) and the individual electrodes (44) have substantially the same residual stress characteristics relative to the piezoelectric element (col. 3, line 47 - col. 4, line 4 & Figs. 1-3).

Regarding claim 3:

Takahashi et al. disclose all the limitations of claim 1, and that the sintered members (42) and the individual electrodes (44) are made of the same material (col. 3, lines 47-51).

Regarding claim 4:

Takahashi et al. disclose all the limitations of claim 3, and that the sintered members (42) and the individual electrodes (44) have substantially the same shape and same size (Figs. 1-3).

Regarding claim 5:

Takahashi et al. disclose all the limitations of claim 1, and that each of the individual electrodes (44), other than the outermost one with respect to the arrangement direction of the plurality of individual electrodes, is surrounded with corresponding ones of the individual electrodes arranged in a predetermined pattern (Fig. 3); and

wherein the outermost one of the individual electrodes (e.g. right most electrode 44) with respect to the arrangement direction of the plurality of individual electrodes is surrounded with a corresponding one of the individual electrodes and a corresponding one of the sintered members (42) arranged in substantially the same pattern as the predetermined pattern (Fig. 3).

Regarding claim 6:

Takahashi et al. disclose all the limitations of claim 1, and that the plurality of pressure chambers (32) are arranged adjacent to each other in a matrix on the plane of the passage unit (Fig. 1);

the plurality of individual electrodes (44) are arranged adjacent to each other in a matrix on the surface of the piezoelectric element (Fig. 1) at positions corresponding to the respective pressure chambers (col. 3, lines 38-41); and

a plurality of sintered members (42) are arranged adjacent to each other so as to surround the plurality of individual electrodes arranged adjacent to each other in a matrix (Figs. 1 and 3).

Claim 8 is rejected under 35 U.S.C. 102(b) as being anticipated by Takagi (US 6536880 B2).

Regarding claim 8:

Takagi discloses an ink-jet head, comprising:

a passage unit (cavity plate 10) in which a plurality of pressure chambers (pressure chambers 16) each connected to a corresponding nozzle (col. 3, lines 47-49) are arranged adjacent to each other in a matrix along a plane (Fig. 3); and

an actuator unit (actuator 20) that is fixed to the passage unit (col. 3, lines 15-18) to change the volume of the pressure chambers (col. 1, lines 17-21),

wherein the actuator unit includes:

a plurality of piezoelectric elements (piezoelectric sheets 21-30) that are put in layers and cover the plurality of pressure chambers arranged adjacent to each other in a matrix (col. 4, lines 9-11 and Fig. 5),

a plurality of individual electrodes (drive electrodes 36) that have been sintered (the method of forming a device is not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight) on a surface of one of the plurality of piezoelectric elements (piezoelectric sheet 26) and are arranged adjacent to each other in a matrix at positions corresponding to the respective pressure chambers (col. 4, lines 13-16 and Fig. 9),

a plurality of sintered members (dummy electrodes 36') of substantially the same residual stress characteristics as the individual electrodes (col. 5, lines 7-12 show that the dummy electrodes are made of the same material and are sintered at the same time as the individual electrodes; therefore, they share substantially equal residual stress characteristics) at positions other than positions corresponding to the pressure chamber (Figs. 6 and 9) and that are, on the surface of the one of the plurality of piezoelectric elements (Fig. 6), arranged adjacent to each other (adjacent in the D2 direction) so as to surround the plurality of individual electrodes arranged adjacent to each other in a matrix (Fig. 6), the sintered members and the individual electrodes having substantially the same residual stress characteristics relative to the piezoelectric elements (col. 5, lines 7-12 shows that electrodes 36 and 36' were formed at the

same time in the same way with the same material; thus their residual stresses would be substantially the same), and

a common electrode (common electrode 35) that is formed, on a surface of the one of the piezoelectric elements (piezoelectric sheet 27) opposite to the surface provided with the individual electrodes (Fig. 7), to span the plurality of pressure chambers (Fig. 5).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi et al. (US 5266964) in view of Sakaida (US 6174051 B1).

Regarding claim 7:

Takahashi et al. disclose all the limitations of claim 1, but **Takahashi et al. do not expressly disclose** that that the actuator unit further includes a common electrode that is formed, on a surface of the piezoelectric element opposite to the surface provided with the individual electrodes, to span the plurality of pressure chambers.

However, Sakaida discloses an actuator unit that includes a common electrode (outer electrode 28) that is formed on a surface of a piezoelectric element (outer piezoelectric ceramic layer 24) opposite to the surface provided with individual electrodes (Fig. 2), to span a plurality of pressure chambers (col. 6, lines 66-67 and Fig. 2).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize an outer electrode that formed on a surface of the piezoelectric element opposite the surface provided with individual electrodes, such that the outer electrode spans a plurality of pressure chambers, such as disclosed by Sakaida, into the invention of Takahashi et al. The motivation for doing so, as taught by Sakaida, is to synchronously deform the laminated piezoelectric element in shear mode, and deform the outer piezoelectric element in an expansion mode to enhance electromechanical transducing efficiency (col. 5, lines 4-14).

Claims 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 6695439 B2) in view of Takeuchi et al. (US 5512793).

Regarding claim 15:

Takahashi discloses an ink-jet head, comprising:

a passage unit (ink chamber unit 20) in which a plurality of pressure chambers (ink chambers 24), each connected to a corresponding nozzle (col. 7, lines 32-37), are arranged adjacent to each other along a plane (Fig. 1); and

an actuator unit (piezoelectric transducer 10) that is fixed to the passage unit (Fig. 1) to change the volume of the pressure chambers (col. 9, lines 47-65),

wherein the actuator unit includes:

a piezoelectric element (piezoelectric plate 11) that spans a plurality of pressure chambers (Fig. 1),

a plurality of individual electrodes (second driving electrodes 13) on a surface of the piezoelectric element at positions corresponding to the respective pressure chambers (col. 7, lines 58-60 and Fig. 1).

Takahashi does not expressly disclose one or more sintered dummy electrodes at positions other than positions corresponding to the pressure chambers and that are, on the surface of the piezoelectric element provided with the plurality of individual electrodes, spaced from an outermost one of the individual electrodes with respect to an arrangement direction of the plurality of individual electrodes, in an outward direction from the plurality of individual electrodes, wherein the sintered dummy electrodes and the individual electrodes have substantially the same shape and same size.

However, Takeuchi et al. disclose an ink-jet head in which dummy elements (displacement adjusting layers 60), including dummy electrodes (upper and lower electrodes 72 and 76), are sintered (col. 8, lines 53-67 & col. 10, lines 2-19) into positions other than those corresponding to active pressure chambers (Fig. 2) and to be outwardly spaced from outermost individual elements (P/E elements 70) with respect to an arrangement direction of the plurality of individual elements (col. 9, lines 45-52 and Fig. 2), and wherein the dummy elements and individual elements have identical construction (col. 10, lines 2-19).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize into Takahashi's invention, dummy electrodes at positions other than positions corresponding to active pressure chambers, on the surface of the piezoelectric element provided with the plurality of individual electrodes, spaced from an outermost one of the individual electrodes with respect to an arrangement direction of the plurality of individual

electrodes, in an outward direction from the plurality of individual electrodes, and wherein the sintered dummy electrodes and the individual electrodes have substantially the same shape and the same size. Motivation for utilizing such dummy electrodes, as suggested by Takeuchi et al., is to provide rigidity at portions of the surface on which the dummy electrodes are formed, so as to adjust the amount of deformation of the outermost active pressure chambers (col. 9, lines 56-63).

Regarding claim 16:

Takahashi as modified by Takeuchi et al. disclose all the limitations of claim 15, and **Takeuchi also disclose** that the sintered dummy elements (60) and the individual elements (70) have substantially the same residual stress characteristics relative to the surface on which they are mounted (this characteristic is inherent with the disclosure of col. 8, lines 53-67 & col. 10, lines 2-19).

Therefore, the combination as a whole discloses that the sintered dummy electrodes and the individual electrodes have substantially the same residual stress characteristics relative to the piezoelectric element.

Regarding claim 17:

Takahashi as modified by Takeuchi et al. disclose all the limitations of claim 15, and **Takeuchi also disclose** that the sintered dummy elements (60) and the individual elements (70) are made of the same material (col. 10, lines 2-19).

Therefore, the combination as a whole discloses that the sintered dummy electrodes and the individual electrodes are made of the same material.

Regarding claim 18:

Takahashi as modified by Takeuchi et al. disclose all the limitations of claim 15, and **Takahashi also discloses** that each of the individual electrodes (13), other than the outermost one with respect to the arrangement direction of the plurality of individual elements, is surrounded with corresponding ones of the individual electrodes arranged in a predetermined pattern (col. 7, lines 58-60 and Fig. 4); and

Takeuchi et al. also disclose that the outermost one of the individual elements (70) with respect to the arrangement direction of the plurality of individual elements is surrounded with a corresponding one of the individual elements and a corresponding one of the sintered dummy elements arranged in substantially the same pattern as the predetermined pattern (Fig. 2).

Regarding claim 19:

Takahashi as modified by Takeuchi et al. disclose all the limitations of claim 15, and **Takahashi also discloses** that the plurality of pressure chambers (24) are arranged adjacent to each other in a matrix on the plane of the passage unit (Figs. 3-4);

the plurality of individual electrodes (13) are arranged adjacent to each other in a matrix on the surface of the piezoelectric element at positions corresponding to the respective pressure chambers (col. 7, lines 58-60 and Fig. 4); and

Takeuchi et al. also disclose that a plurality of the sintered dummy elements (60) are arranged adjacent to each other so as to surround the plurality of individual elements (Fig. 2).

Regarding claim 20:

Takahashi as modified by Takeuchi et al. disclose all the limitations of claim 15, and **Takahashi also discloses** that the actuator unit (10) further includes a common electrode (first driving electrode 12) that is formed, on a surface of the piezoelectric element opposite to the

surface provided with the individual electrodes (Fig. 1), to span the plurality of pressure chambers (col. 7, lines 55-57).

Regarding claim 21 (as best understood):

Takahashi discloses an ink-jet head, comprising:

a passage unit (ink chamber unit 20) in which a plurality of pressure chambers (ink chambers 24), each connected to a corresponding nozzle (col. 7, lines 32-37), are arranged adjacent to each other in a matrix along a plane (Figs. 1 and 4); and

an actuator unit (piezoelectric transducer 10) that is fixed to the passage unit (Fig. 1) to change the volume of the pressure chambers (col. 9, lines 47-65),

wherein the actuator unit includes:

a plurality of piezoelectric elements (piezoelectric layers 11a-11d) that are put in layers and cover the plurality of pressure chambers arranged adjacent to each other in a matrix (Fig. 1),

a plurality of individual electrodes (second driving electrodes 13) on a surface of one of the plurality of piezoelectric elements (Fig. 1) and are arranged adjacent to each other in a matrix at positions corresponding to the respective pressure chambers (col. 7, lines 58-60 and Figs. 1 and 4); and

a common electrode (first driving electrode 12) that is formed, on a surface of one of the piezoelectric elements opposite to the surface provided with the individual electrodes (Fig. 1), to span the plurality of pressure chambers (col. 7, lines 55-57).

Takahashi does not expressly disclose a plurality of sintered dummy electrodes at positions other than positions corresponding to the pressure chambers and that are, on the

surface of the one of the plurality of piezoelectric elements, arranged adjacent to each other so as to surround the plurality of individual electrodes arranged adjacent to each other in a matrix, the sintered dummy electrodes and the individual electrodes having substantially the same residual stress characteristics relative to the piezoelectric elements, and wherein the sintered dummy electrodes and the individual electrodes have substantially the same shape and same size.

However, Takeuchi et al. disclose an ink-jet head in which dummy elements (displacement adjusting layers 60), including dummy electrodes (upper and lower electrodes 72 and 76), are sintered (col. 8, lines 53-67 & col. 10, lines 2-19) into positions other than those corresponding to active pressure chambers (Fig. 2) and to be arranged adjacent the outermost individual elements (P/E elements 70) so as to surround the individual elements that are arranged adjacent each other (col. 9, lines 45-52 and Fig. 2), and wherein the dummy elements and individual elements have identical construction (col. 10, lines 2-19).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize into Takahashi's invention, dummy electrodes at positions other than positions corresponding to active pressure chambers and that are, on the surface of the one of the plurality of piezoelectric elements, arranged adjacent each other so as to surround the plurality of individual electrodes adjacent each other in a matrix, and wherein the sintered dummy electrodes and the individual electrodes have substantially residual stress characteristics relative to the piezoelectric elements, and have the same shape and the same size. Motivation for utilizing such dummy electrodes, as suggested by Takeuchi et al., is to provide

rigidity at portions of the surface on which the dummy electrodes are formed, so as to adjust the amount of deformation of the outermost active pressure chambers (col. 9, lines 56-63).

Response to Arguments

Applicant's arguments filed 10/29/2007 have been fully considered.

Applicant's arguments with respect to claims 1-7 have been considered but are moot in view of the new ground(s) of rejection. Please see the above anticipation rejection based on the disclosure provided by Takahashi et al. This antedating reference discloses one or more sintered members that are of the same residual stress characteristics as individual electrodes.

Applicant argues, regarding claims 20 and 21, that there would be no reason to add the common electrode of Sakaida to drive the piezoelectric ceramic layers 40 of Takahashi because it is already driven by the positive electrodes 44 and the negative electrodes 42. Examiner respectfully disagrees. As shown in the previous Office Action, Sakaida shows that, by supplementing the inner electrode (26, 27) driving with driving with the common electrode (28), the electromechanical transducing efficiency is increased because the piezoelectric ceramic layers are being deformed in both the shear and expansion modes. Therefore, the combination of Takahashi as modified by Sakaida is both logical and proper. Examiner notes that a similar combination has been made in the current Office Action regarding claim 7.

Applicant argues, regarding claim 8, that Takagi fails to disclose the limitation of "one or more sintered members of the same residual stress characteristics as the individual electrodes." However, this limitation is not recited in independent claim 8. Rather claim 8 states that the sintered members have "substantially the same residual stress characteristics." As previously

shown (see, for example, Response to Arguments in Office Action dated 8/9/2007), Takagi discloses such a feature.

Applicant's arguments with respect to claims 15-21 have been considered but are moot in view of the new ground(s) of rejection. Please see the above obviousness-type rejection based on the combination of Takahashi as modified by Takeuchi et al. A logical combination of these references shows that it would have been obvious to provide one or more sintered dummy electrodes at positions other than positions corresponding to the pressure chambers.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby 2. Fidler 1/10/2008

Shelby Fidler
Patent Examiner
AU 2861

MATTHEW LUU
SUPERVISORY PATENT EXAMINER